

The opinion in support of the decision being entered today was **not** written for publication and is **not** binding precedent of the Board.

Paper No. 23

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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Ex parte KATHLEEN MARIE DOVERSPIKE, JOHN ADAM EDMOND, HUA-SHUANG KONG, HEIDI MARIE DIERINGER and DAVID B. SLATER JR.

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Appeal No. 2002-0575  
Application No. 09/477,982

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HEARD: February 4, 2003

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Before HAIRSTON, JERRY SMITH, and FLEMING, Administrative Patent Judges.  
HAIRSTON, Administrative Patent Judge.

DECISION ON APPEAL

This is an appeal from the final rejection of claims 18 through 23.

The disclosed invention relates to a method of producing a vertically oriented light emitting diode (LED) using an indium gallium nitride active layer sandwiched between two thin undoped layers of gallium nitride in a nitrogen atmosphere on a silicon carbide substrate. A thin layer of aluminum gallium nitride is also formed in the nitrogen atmosphere. All other layers of the LED are formed in a hydrogen atmosphere.

Claim 18 is the only independent claim on appeal, and it reads as follows:

18. A method of producing a vertically oriented light emitting diode that is capable of emitting light in the red, green, blue, violet and ultraviolet portions of the electromagnetic spectrum, the method comprising:

successively growing an n-type conductive buffer layer in a hydrogen atmosphere and an n-type gallium nitride layer in the hydrogen atmosphere on a silicon carbide substrate;

thereafter successively growing a first thin layer of undoped gallium nitride in a nitrogen atmosphere, an indium gallium nitride quantum well in the nitrogen atmosphere, a second thin layer of undoped gallium nitride in the nitrogen atmosphere, and a thin layer of undoped aluminum gallium nitride in the nitrogen atmosphere;

wherein at least the first layer of undoped gallium nitride and the quantum well are grown at the same temperature and without a growth stop therebetween; and

thereafter successively growing a layer of p-type aluminum gallium nitride in a hydrogen atmosphere and a layer of p-type gallium nitride in the hydrogen atmosphere.

The references relied on by the examiner are:

Sugiura et al. (Sugiura)	5,932,896	Aug. 3, 1999 (filed Sept. 5, 1997)
Yuasa et al. (Yuasa)	6,017,774	Jan. 25, 2000 (filed Dec. 23, 1996)

Amano et al. (Amano), "Fabrication and Properties of AlGaIn/GaInN Double Heterostructure Grown on 6H-SiC (0001)," Materials Research Society Symposium Proceedings, Vol. 395, 1996, pp. 869 through 877.

Claims 18 through 23 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Amano in view of Sugiura and Yuasa.

Reference is made to the final rejection (paper number 9), the briefs (paper numbers 14 and 16) and the answer (paper number 15) for the respective positions of the appellants and the examiner.

OPINION

We have carefully considered the entire record before us, and we will reverse the obviousness rejection of claims 18 through 23.

Amano discloses a LED fabricated on a silicon carbide substrate. The examiner acknowledges (final rejection, page 2) that “Amano does not disclose (1) growing undoped GaN layers grown to sandwich [sic, sandwich] the GaInN active layer, (2) providing specific carrier gas of hydrogen or nitrogen for specific set of layers.”

With the exception of a single embodiment, all of the LEDs formed in Sugiura are formed on a sapphire substrate. The single embodiment (Figure 18) formed on a silicon carbide substrate 51 has an indium gallium nitride layer 54 sandwiched between two doped layers of gallium nitride 53 and 55. Another embodiment (Figure 3) that has an indium gallium nitride layer 16 sandwiched between two gallium nitride layers 15 and 17 is formed on a sapphire substrate 11. This latter embodiment is silent as to doping of the two gallium nitride layers. In other embodiments (Figures 24 through 38), the undoped gallium nitride layer in each of the embodiments is denoted by the prefix “un.” Although we agree with the examiner (final rejection, page 3) that “Sugiura et al teaches the suitability of using undoped GaN layers,” we do not, however, agree with the examiner that “[i]t would have been obvious to one of ordinary skill in the art to form undoped GaN layers in place of doped GaN layers in the invention of Amano et al to sandwich the InGaN active device layer.” The examiner has not successfully demonstrated that Sugiura teaches interchangeability of doped and undoped gallium nitride layers in LEDs. We likewise agree with the examiner (final

rejection, page 3) that Sugiura discloses the use of nitrogen and hydrogen gases while growing layers in a LED. Notwithstanding the use of such gases, the examiner has failed to show that the two gases are used at specific times to form specific layers in the LED.

With respect to the specifically claimed step of forming the first undoped layer of gallium nitride and the indium gallium nitride layer at the same temperature, the examiner turns to Yuasa which teaches (column 22, lines 44 through 51) that the two layers may be formed at substantially the same temperature in the presence of an organic radical. Appellants' arguments (reply brief, page 2) to the contrary notwithstanding, nothing in the claims on appeal precludes the presence of the organic radical during the formation of the two different layers.

In summary, the examiner has failed to set forth a prima facie case of obviousness because Amano, Sugiura and Yuasa neither teach nor would have suggested to one of ordinary skill in the art to sandwich a layer of indium gallium nitride between two undoped layers of gallium nitride, and to form such layers in a nitrogen atmosphere. Thus, the obviousness rejection of claims 18 through 23 is reversed.

The decision of the examiner rejecting claims 18 through 23 under 35 U.S.C. § 103(a) is reversed.

REVERSED

Appeal No. 2002-0575  
Application No. 09/477,982

KENNETH W. HAIRSTON  
Administrative Patent Judge

JERRY SMITH  
Administrative Patent Judge

MICHAEL R. FLEMING  
Administrative Patent Judge

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